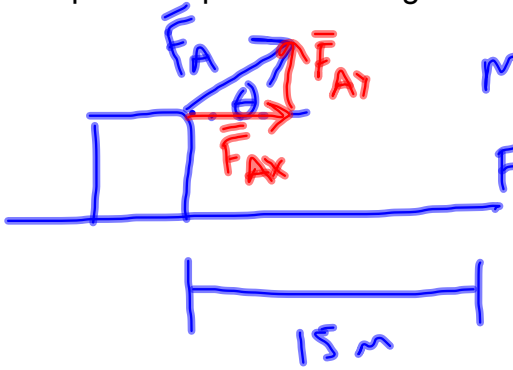
A rope attached to an 18.0 kg crate is pulled with 125.0 N at a certain angle from the ground. The crate is dragged 15.0 meters along the ground, and it takes 1400.5 J to accomplish the pull. What angle is the rope being pulled, relative to the ground?



$m = 18.0\,kg$ $\quad W = 1400.5\,J$

$F_A = 125\,N$

$$W = F_A d \cos\theta$$

$$\theta = \cos^{-1}\left(\frac{W}{F_A d}\right)$$

$$= \cos^{-1}\left[\frac{1400.5\,J}{(125\,N)(15\,m)}\right]$$

$$= 41.7^\circ$$

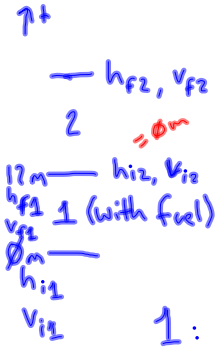
Power:

- Definition → work done per time

$$P = \frac{W}{t} = F v$$

- Units: Watts [$1\ W = 1\ J/s$]

A 0.75 kg rocket is launched straight up. The fuel propels the rocket with a constant 6.00 N of force upward over 12.0 m for 2.00 s, at which time the fuel runs out.
a) What is the total height that the rocket will reach? (This includes the distance the rocket continues after the fuel runs out.)
b) What is the power of this rocket generated while the rocket burns its fuel?



$h_{i1} = 0\ m$ $\quad v_{i1} = 0\ m/s$

$h_{f1} = 12\ m$

$h_{i2} = 0\ m$ $\quad v_{f1} = v_{i2} = ?$

$h_{2f} = ?$ $\quad v_{f2} = 0\ m/s$

1: $W_A = \Delta E_1$

$= (K_{f1} - K_{i1}) + (U_{f1} - U_{i1})$

$F_A d \cos\theta = \frac{1}{2} m v_{f1}^2 + m a_g h_{f1}$

$F_A d = \frac{1}{2} m v_{f1}^2 + m a_g h_{f1}$

$v_{f1}^2 = \frac{2}{m}\left[F_A d - m a_g h_{f1}\right]$

$= \frac{2}{(.75\ kg)}\left[(6N)(12\ m) - (.75\ kg)(-9.8\ m/s^2)(12\ m)\right]$

$= 427.2\ m^2/s^2$

$K_{i2} + U_{gi2} = K_{f2} + U_{gf2}$

$\frac{1}{2} m v_{i2}^2 + m a_g h_{i2} = \frac{1}{2} m v_{f2} + m a_g h_{f2}$

$h_{f2} = \frac{v_{i2}^2}{2 a_g}$

$= \frac{(427.2\ m^2/s^2)}{2(9.8\ m/s^2)}$

$= 21.8\ m$

b) $P = \frac{W}{t}$

$= \frac{F_A d \cos\theta}{t}$

$= \frac{(6N)(12\ m)}{2\ s}$

$= 36\ W$